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ABSTRACT

A study sought to acquire new insights into cross-linguistic processing strategies of native English (NE) readers and native Spanish (NS) readers after they read informational texts organized according to preferred writing styles in Spanish. Previous studies suggest that: NS readers will be more efficient processors of embeddedness than NE readers; NS readers will recall considerably more of the propositional textbase than NE readers; processing strategies at the sentence and paragraph level may differ considerably between groups; and NE readers may sometimes employ a "read and hold" strategy for assembling propositions into their mental representations. Of particular interest are the shapes of the representations created by both groups, particularly their situation models. Participants were 76 native readers of Spanish (NRS) attending high school in Peru and 24 native readers of English (NRS) attending an American high school. Tests were created by the researchers. Nine essays on three different topics were developed; for each topic, researchers created a kernel text. Both groups read texts in Spanish during class times; Spanish readers wrote in Spanish, English readers wrote in English. Proportional recall scores differed significantly between the NRS group and the NRE group. Both groups have similar profiles for the textbase representations of the reading selections, but divergent profiles appear when their inference generation is compared. This dichotomy brings to mind some new hypotheses concerning the shapes of the mental representations for both groups as well as some strategies that may be influencing their processing. Appended are the texts and sample recalls in English and Spanish. (Contains 5 figures and 16 references. (NKA)

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A COMPARISON OF FIRST AND SECOND LANGUAGE READERS' SITUATION MODELS AS EVIDENCED IN A RECALL TASK.

Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, April 25, 2000

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INTRODUCTION

Text comprehension has come to be viewed as a multilevel representation with memory traces constructed at the word, the sentence, and the discourse levels. To be specific, the reader's memory for texts consists of a textbase level encoded as propositions that represent the relational units expressed by the sentences of the passage. This propositional representation of the text contains both explicit text propositions and a small number of inferences that provide local coherence between propositions. This semantic representation of the text is remembered in varying degrees during a recall task (van Dijk & Kintsch, 1983). At a higher level, readers integrate the text into a coherent representation by utilizing information generated from general background knowledge in order to create a mental model (Johnson-Laird, 1983) or a situation model (Kintsch, 1988). Perfetti (1989) argues that the important distinction between text meaning, as determined by the textbase representation, and text interpretation, as determined by the mental model, is the amount and type of inferential activity. Kintsch (1998) contends that readers supplement information provided by a text with knowledge and experiences they have stored in long-term memory. This process instantiates a personal interpretation of the text, i.e., a situation model, that is composed of the text-derived propositions as well as propositions contributed from long-term memory. In the present study, we plan to compare the proportional recall scores for the propositional textbase as well as the number and types of inferences produced in the mental representations produced by two groups of high school students–native readers of English and native readers of Spanish. We are especially interested in the situation models of the two groups as well as the similarities and differences in their profiles.

Spanish texts present specific problems for native English speakers because native writers of Spanish often introduce non-essential information in the form of additive clauses. A comparison of texts written by native Spanish and by native English speakers on the same topic showed that the Spanish texts contained longer sentences, digressions within paragraphs, and a predominance of coordinate rather than subordinate structures (Santana-Seda, 1975). Kaplan (1966) found a similar preference for digressions and elaborations in the English compositions of Spanish-speaking students in a study of writing patterns of ESL students. If we assume that this preference exists, then native speakers of Spanish at the secondary school level have probably developed strategies for reading paragraphs in Spanish that will aid their comprehension of texts with long sentences and multiple embedded clauses. As a consequence, these strategies should prompt written recalls that adhere to the same form.

The purpose of the following study is to acquire new insights into cross-linguistic processing strategies of native English (NE) readers and native Spanish (NS) readers after they have read informational texts organized according to preferred writing styles in Spanish. Previous studies suggest that (a) NS readers will be more efficient processors of embeddedness than NE readers; (b) NS readers will recall considerably more of the propositional textbase than NE readers; (c) processing strategies at the sentence and paragraph level may differ considerably between groups; and (d) NE readers may sometimes employ a "read and hold" or delay strategy for assembling propositions into their mental representations. However, there is little research to indicate the amount and type of inferential activity that L1-NS readers and L2-NE readers will produce to create a situation or mental model of an informational text that conforms to the L1-NS readers' preferred writing style and differs from the L2-NE readers' style. We are particularly interested in the shapes of the representations created by both groups and in particular their situation models.

METHOD

Participants

L1 readers: Native readers of Spanish (NRS)

- NRS group has 76 participants attending private high schools in Lima, Peru.
- A 10 item reading comprehension test identified fewer than 1% as poor readers.
- All high school students in Peru have a great deal of knowledge about the history of the Incas.

L2 readers: Native readers of English (NRE)

- NRE group has 24 participants attending public high school in a suburban district in the US.
- All were in third year of high school Spanish and 14 of these had studied Spanish in junior high.
- Their average percentile rank for reading comprehension in English was 86.5 on the *Comprehensive Tests of Basic Skills*.
- Immediately prior to participating in this study, they had completed a unit on Incan history

Materials

Packets ordered as follows:

- A cover sheet with directions for completing packets
- Three reading selections written in Spanish, each on a different topic and at a different level of syntactic complexity
- Three blank pages, one after each reading for writing recall protocols
- Three short questionnaires about the preceding text

Treatment combinations: Nine historical essays on three different topics concerning Incan civilization

- Topic A: El crimen y su castigo (Crime and Punishment)
- Topic B: Las ciudades: La administración y la arquitectura (Cities: Administration and Architecture)
- Topic C: El ocaso de los Incas (The Decline of the Incas
- Topics A and B were organized as a collection of descriptions with examples.
- Topic A was cause & effect whereas Topic B contained spatial layouts and procedures.
- Topic C was a description of the conquest of the Incas organized as a descriptive narrative.

For each topic, the authors created:

- A baseline or kernel text with X propositions was identified as the Level I (LI) text.
- A Level II (LII) text was the LI text with one additional embedded clause per sentence whose propositions were labeled as Y propositions.
- A Level III (LIII) text contained all of the LI and LII texts with one additional embedded clause per sentence whose propositions were labeled as Z propositions.

Because the LII and the LI texts are embedded in the LIII text, we have chosen to include a sample of the LIII text for Topic B in Appendix A.

Procedures

Administration of the Test Instrument.

- Both groups read texts in Spanish during regular class times.
- Both groups had as much time as needed to read and to write everything they could remember.
- Spanish readers wrote in Spanish; English readers wrote in English.
- All participants were monitored to insure compliance with these instructions.

Scoring the Textbase Representations.

The first author created templates in both English and Spanish to represent the semantic content of each reading selection.

- Total number of correct X propositions, cx, recalled for the kernel text and the maximum possible number of these propositions, mx, determined the proportional score, cx/mx for kernel text recall.
- The recall of the Y propositions was measured by the score cy/my where cy represents the number of correctly recalled propositions out of a possible maximum of my.
- The score for the recall of the Z propositions was given by cz/mz.
- Interrater reliability for the NRE group was .96.

- Interrater reliability for the textbase representation of the NRS group was .99.

Scoring Inferential Propositions in the Readers' Recall Protocols.

We counted inferred propositions found in each subject's recalls and divided them into three categories:

- **within-text inferences** (propositions that summarized or synthesized the text),
- **elaborative inferences** (propositions that combined elements of the text with prior-knowledge structures), and
- **incorrect inferences** (propositions that contradicted information in the text or that contained errors due to misreading the surface code).
- A few propositions were not counted because they were repetitions or ideas unrelated to the text.
- Interrater reliability for total number of inferences for the NRE group was .99 with .98 for within-text inferences, .95 for elaborative inferences and .97 for incorrect inferences.
- Interrater reliability for total number of inferences for the NRS was .99 with .98 for within-text inferences, .99 for elaborative inferences, and .96 for incorrect inferences.

Research Design.

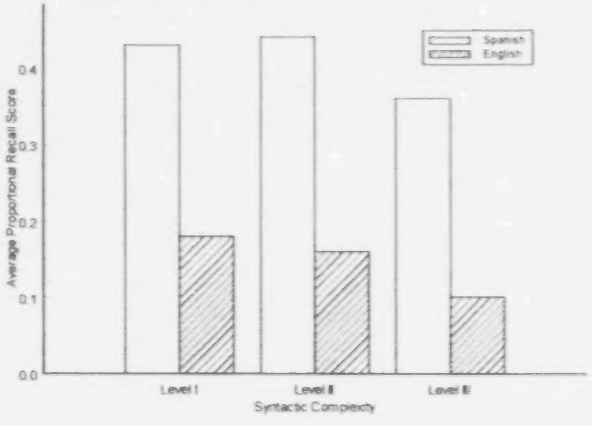
- A randomized factorial (Latin Square) design of 3 levels of syntactic complexity and 3 different reading topics.
- Native Spanish readers (NRS group; n=76) and native English readers (NRE group: n=24) were randomly assigned to one of six packages with L2-NRE group having four replications per package and L1-NRS group having six replications in some packages and seven in others.

RESULTS

Recall of the kernel text

- Proportional recall scores differed significantly between NRS group and NRE group.
- Proportional recall scores for LI text were substantially greater for NRS group than NRE group.
- Main effect of syntactic complexity (SC) was significant, and no interaction between groups or reading topics appeared.
- Both groups have a similar pattern with less recall of kernel text at LIII, but equal amounts at LI and LII.
- Main effect of reading topic was significant: Topic B had less average recall and Topics A and C were similar.

Figure 1. Average Kernel Recall Scores by Language Group and Levels of Syntactic Complexity

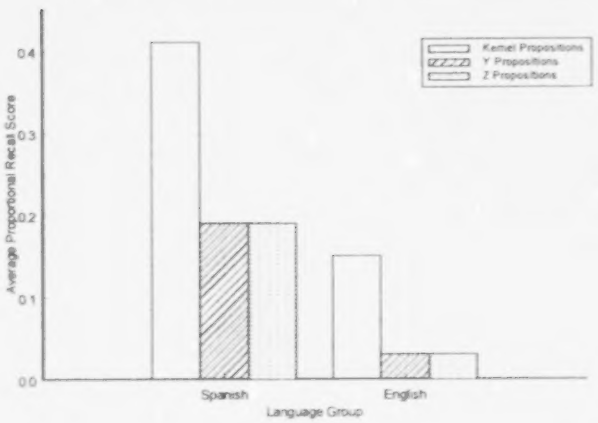


- A significant interaction appeared between groups and reading topics where NRS always recalled a larger proportion of kernel propositions than the NRE, but difference was significantly smaller for Topic B.

Recall of embedded clauses: Y and Z propositions

- Groups differed significantly in recall of both Y and Z propositions with NRS group recalling a larger proportion of both Y and Z clauses than NRE group.
- No significant impact for reading topic appeared.
- NRS group recalled average 41% of kernel propositions, but half that for Y and Z propositions.
- NRE group recalled average of 15% of kernel propositions, but one fifth as many for Y and Z propositions.

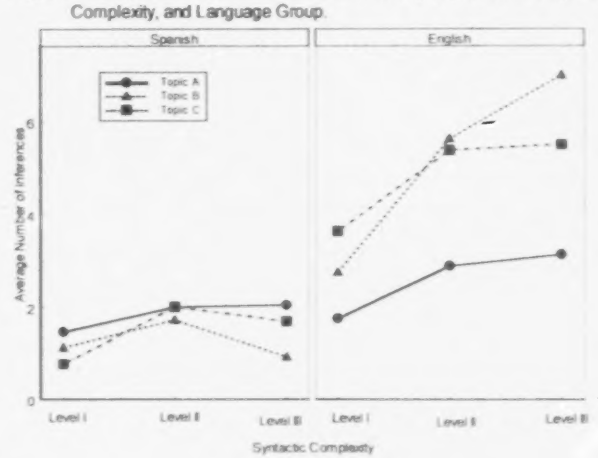
Figure 2: Average Recall Scores by Language Group and Proposition Type



Within Text Inferences

- All three main effects of group, SC and reading topic were significant.
- NRE group produced significantly more within-text inferences than NRS group.
- Figure 3 depicts the significant triple interaction of group, SC, and reading topic that appeared.
- For NRS group, close means suggest no systematic increase of within-text inferences with SC.
- For NRE group, a significant effect of SC appeared where average number of within-text inferences increased with level of SC. This is demonstrated in Figure 3.
- For NRS group, there was no significant effect of reading topic
- For NRE group, Topic A triggered significantly fewer within-text inferences than Topics B and C.

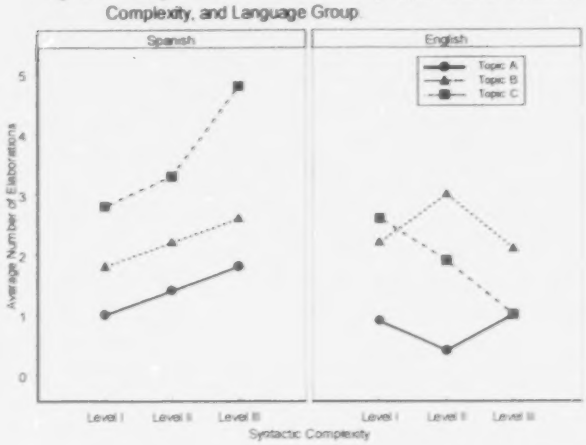
Figure 3: Average Number of Within-Text Inferences by Topic, Level of Syntactic Complexity, and Language Group.



Elaborations

- There was a significant triple interaction for the average number of elaborative inferences.
- For the NRS group elaborations increased significantly with increasing SC.
- Main effect of reading topic was significant with Topic C producing the largest average number of elaborations followed by Topics B and A.
- For the NRS group, no significant interaction between reading topic and SC occurred
- For the NRE group, the number of elaborations follow a more irregular pattern: the level of SC did not significantly effect the average number of elaborations, but average number of elaborations for Topic A were significantly smaller than for Topics C and B.
- Even when Topic C seems to create an interaction, there was no significant interaction between reading topic and syntactic complexity for the NRE group.

Figure 4: Average Number of Elaborations by Topic, Level of Syntactic Complexity, and Language Group

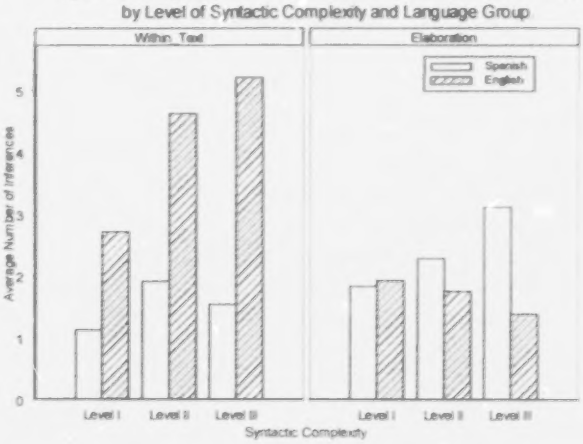


Profile of groups and inference generation

A comparison of the two groups in terms of their average number of within-text inferences and elaborations shows a clear pattern.

- For NRE group, within-text inferences increased with SC.
- For NRS group, there was no systematic pattern that corresponded to SC.
- For NRS group, elaborations increased slightly with increasing SC.
- For NRE group, there was no significant change as SC increased.

Figure 5: Average Number of Within-Text and Elaboration Inferences, by Level of Syntactic Complexity and Language Group



DISCUSSION

Our results show both groups, L1-NS readers and L2-NE readers, have similar profiles for the textbase representations of the reading selections; however, divergent profiles appear when we compare their inference generation. This dichotomy brings to mind some new hypotheses concerning the shapes of the mental representations for both groups as well as some strategies that may be influencing their processing.

New hypotheses about the mental representations of the L1-NS and L2-NE readers:

- L1-NS readers seemed to process the increasing syntactic complexity of the textbases easily;
- L1-NS readers may have a preferred writing style that conforms readily to the patterns of embeddedness created for these reading selections; therefore,

- L1- NS readers may have utilized the structure of embeddedness apparent in each text as a mnemonic device to remember the reading selections and to reproduce them as faithful representations of their propositional textbases with an occasion elaboration to enrich the textbase.

- L2-NE readers may not have had sufficiently developed knowledge structures to process easily the syntactic complexity presented in the LII and particularly in the LIII texts;
- L2-NE readers may prefer a writing style that relies more heavily on shorter sentences with less embeddedness than the patterns created for these reading selections; therefore,
- L2-NE readers may have employed a "read-ahead" strategy (Horiba, 1996) that helped them to produce a written representation of the reading selections that were less of a replica of the textbase propositions and more of an interpretation of the texts especially for the LII and the LIII texts. **(See Appendix B)**

Different text types seemed to affect inference generation for L1-NS and L2-NE readers in a similar way. However, Topic B seemed to diminish the recall of the propositional textbase for the L1-NS readers considerably more than for the L2-NE readers.

New hypotheses concerning effects of read topics.

- Topic B was not as tightly connected as either Topics A or C because it contained two thesis statements, one concerning administration and one concerning architecture; therefore, if L1-NS readers were using replication strategy, they would naturally have more problems with Topic B.

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APPENDIX A

(Spanish version - Topic B - Level 3 - Y propositions in [illegible] and Z propositions in [illegible])

LAS CIUDADES: LA ADMINISTRACIÓN Y LA ARQUITECTURA

Las ciudades incas, **la más importante de las cuales fue el Cuzco,** eran muy diferentes de las nuestras, *que mezclan tiendas, oficinas y hogares.* Eran básicamente centros administrativos. Pocas eran las personas que habitaban, *propiamente dicho,* en la ciudad **además de los funcionarios incaicos.** En su mayor parte, la gente, **organizada en allyus**, vivía en los alrededores, *que estaban llenos de poblados pequeños.* Iban a la ciudad, *que se conectaba bien con muchos caminos,* únicamente cuando tenían que resolver, **con las autoridades,** algún asunto.

En efecto, la ciudad era principalmente un centro de gobierno. En ella se conservaban, **con gran cuidado y exactitud,** todos los datos, *como los censos de población,* del imperio. Por ejemplo, se guardaban los "quipus", *al cuidado de los quuipucamayocs,* con los detalles de las mercancías almacenadas **las cuales venían de todas partes del imperio.** Los funcionarios locales, *cada cierto tiempo,* visitaban las ciudades para, **además de llevar el tributo al Inca,** informar a los oficiales sobre el estado de las aldeas.

Cada ciudad tenía un palacio destinado al Inca y al gobernador local. En el centro del palacio, *que era la parte más protegida,* se encontraban, **alrededor de un patio,** los alojamientos del Sapa Inca y la reina. Cerca de sus habitaciones, *que daban a un jardín,* ***muy florido y bello,*** estaban las de los servidores reales. Otros edificios, *más cercanas a la entrada del palacio,* servían para guardar, **entre muchos otros productos,** los tejidos y el grano. Un edificio importante, *además del palacio,* era el Templo del Sol, **donde la gente celebraba los festivales importantes.** Cerca del templo, *y a poca distancia del palacio,* se hallaba el convento donde vivían las "Vírgenes del Sol" **retiradas de la vista del público.**

Los incas, *unos de los mejores arquitectos de la antigüedad,* construían sus edificios, **tanto militares como religiosos,** sin cemento, con piedras perfectamente cortadas. Además, las frotaban *siguiendo un proceso desconocido,* hasta que las superficies, **originalmente desiguales,** quedaban lisas. Estos bloques rectangulares, *algunos de ellos de increíbles proporciones,* podían ser luego, **con la ayuda de miles de indios,** colocados en su sitio. Los muros de los edificios construidos de este modo, *además de ser muy bellos,* eran, **para poder durar muchos años,** muy sólidos. Ni tan siquiera la hoja afilada de un cuchillo, *por muy fina que fuese,* podía pasar, **por más que uno lo intentase,** entre las piedras. Estos muros incaicos, *construidos hace más de cinco siglos,* han sobrevivido terremotos, **algunos de ellos de increíble fuerza,** que han destruido otros edificios más modernos. Cuando había un temblor, las piedras incas se movían pero sin afectar el muro.

Los incas, *una de las más importantes culturas de América,* **y también una de las más misteriosas,** fueron buenos arquitectos y funcionarios. Sus habilidades administrativas eran evidentes en la buena organización del imperio, *que llegó a tener,* ***en su momento de mayor desarrollo,*** *millones de habitantes,* y la eficiente administración de sus ciudades. Son notables, también, *entre muchas otras cosas,* los ejemplos de su arquitectura que han sobrevivido, **a pesar del paso del tiempo,** hasta nuestros días.

(English version - Topic B Level 3 - Y propositions in bold and Z propositions in italics)

CITIES: ADMINISTRATION AND ARCHITECTURE

The Incan cities, **the most important of which was Cuzco,** were very different from ours, *which mix stores, offices and homes.* They were basically administrative centers. Few were the people that lived, *strictly speaking,* in the cities ***besides the Incan government officials.*** The majority of the people, **organized in allyus,** lived in the surrounding areas, *which were full of small towns.* They would go to the city, *which was well connected by many roads,* only when they had to resolve, **with the authorities,** some matter.

In effect, the city was principally a center of government. In it, were kept, **with great care and exactitude,** all the data, *such as the population census,* for the empire. For example, the "quipus" were kept, *under the care of the "quipucamayocs"*, with all the details about their stored merchandise, **which had come from all parts of the Empire**. The local officials, *every once in awhile*, would visit the cities in order to, **besides taking tribute to the Inca**, inform the government about the state of the small towns.

Each city had a palace destined for the Inca and the local governor. In the center of the palace, *which was the most protected part*, were found, **around a patio,** the accommodations for the Sapa Inca and the queen. Near their rooms, *which looked out on a garden,* ***beautiful and in full flower,*** were those of the royal servants. Other buildings, *closer to the entrance of the palace,* were serving in order to store, **among many other products,** textiles and grain. An important building, *besides the palace,* was the Temple of the Sun, **where the people celebrated the important festivals.** Near the temple, *and at a short distance from the palace,* was found the convent where the "Virgins of the Sun" were living, **withdrawn from public view.**

The Incas, *some of the best architects of antiquity,* used to construct their buildings, **as many military as religious,** without cement, with perfectly cut stones. Besides, they would rub them, *following an unknown process,* until the surfaces, **originally uneven,** were smooth. These rectangular blocks, *some of them of incredible proportions,* were then able, **with the help of thousands of Indians**, to be placed in position. The walls of the buildings constructed in this way, *besides being very pretty,* were, **in order to be able to last many years,** very solid. Not even the sharp blade of a knife, *as thin as it might be,* could pass, **as much as one might try,** between the stones. These Incan walls, *constructed more than five centuries ago,* have survived earthquakes, **some of them of incredible force,** that have destroyed other more modern buildings.

The Incas, *one of the most important cultures of America,* **and one of the most mysterious,** were good architects and government officials. There administrative abilities were evident in the good organization of the Empire, *which ultimately had,* **at their highest point of development,** *millions of inhabitants* and the efficient administration of their cities. They are remarkable, also, *among many other things,* the examples of their architecture that have survived, **in spite of the passage of time,** until the present.

APPENDIX B

The recalls below may have been reorganized to read in the same order as the original texts

Sample recall for NRE group :

P1. The major city in the Incan Empire was Cuzco. *It was the administrative center of the Incas** Many roads *came to it.*

P3. The palace for the Sapa Inca *was there*. *When you entered the palace, you saw two rooms***, one for the Sapa Inca, and one for his wife, the queen. *In the palace, there is also lots of plants and openness, as well as many other rooms. About a block away from the palace* the temple for the Sun God was found. Not far from that was the home for the "Virgins of the Sun."

P4. *The Incas were master builders.* They had perfectly shaped blocks of outstanding size, that were place together without cement. *Their structures were strong and withheld armies.*

P5. *The strength of the Incan army* as well as *their great building skill, helped the Incas to be very organized and very successful.*

Sample recall for NRS group.

P1. Las ciudades incas, de las cuales Cuzco es la más importante, eran muy diferentes a las actuales en donde se mezclan tiendas, oficinas y casas. *En las ciudades incas solo se realizaban labores administrativas en donde se desempeñaban los funcionarios.* La población agrupada en ayllus vivian en los alrededores e iban a las ciudades cuando necesitaban realizar alguna gestión con algún funcionario o autoridad.

P2. En la ciudad se guardaban datos importantes como el censo de la población en los quipus a cargo de los quipucamayocs. Los funcionarios locales también acudian a la ciudad para entregar el tributo al Inca y para informar la situación de las aldeas.

P4. Los incas para construir sus edificios tanto militares como religiosos utilizaron piedras, no usaron cemento. Estas piedras, algunas de grandes dimensiones eran cortadas y colocadas por muchos indios *una sobre otra*, eran frotadas de tal manera, aun desconocida, que quedaban totalmente lisas y no pedia pasarse ni un finisimo cuchillo entre ellas. Estas construcciones además de ser bellas son también resistentes al tiempo, han sobrevivido muchos terremotos, algunos muy fuertes que destruyeron edificios modernos.

P3. En cada ciudad habia un palacio para el Inca y para el gobernador local. En la parte central del palacio, la más protegida se encontraban las habitaciones del Sapa Inca y la reina; cerca a ellas se encontraban las de los servidores reales, y cerca a la entrada del palacio estaban las habitaciones donde se guardaban entre otros productos los tejidos y el grano. Otra construcción importante era el Templo del Sol, donde se realizaban fiestas y cerca del palacio *estaba el templo (incorrect) de las "virgenes del sol"*, fuera de la vista pública.

P.5 Los incas fueron excelentes administradores y arquitectos. Su cultura fue una de las más grandes y más misteriosas.

* Italicized phrases indicate within-text inferences.

**Italicized and underlined phrases indicate elaborative inferences.